

1. A method of treating a flue gas containing a dust or a pollutant, comprising the steps of:

sensibly cooling the flue gas; and

removing at least a portion of the dust from the flue gas by
electrostatic precipitation, thereby forming a dust-reduced flue gas.

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2. The method of claim 1 further including the step of reacting at least a portion of the dust-reduced flue gas with an alkaline material, thereby forming a reaction product.

3. The method of claim 2 further including the step of contacting at least a portion of the dust-reduced flue gas and reaction product with a collecting liquid, thereby forming a pollutant-laden liquid and a treated flue gas.

4. The method of claim 1 further including the step of contacting at least a portion of the dust-reduced flue gas with a collecting liquid, thereby forming a dust-containing liquid.

5. The method of claim 1 wherein the pollutant includes a metal or metallic compound having a metal selected from the group consisting of mercury, selenium, arsenic, lead, chromium, cadmium, beryllium, nickel, manganese, and combinations thereof.

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6. The method of claim 1 wherein the pollutant includes chlorine or a chlorine-containing compound.
7. The method of claim 2 wherein the alkaline material includes ammonia.
8. The method of claim 3 wherein the contacting step includes exposing the dust-reduced flue gas and reaction product to an electrostatic precipitator.
9. The method of claim 3 further including the step of exposing the dust-reduced flue gas and reaction product to an electrostatic precipitator.
10. The method of claim 1 further including the step of contacting at least a portion of the flue gas with an alkaline material.
11. The method of claim 10 wherein the alkaline material includes calcium hydroxide.
12. The method of claim 10 wherein the alkaline material is a solid.
13. The method of claim 10 wherein the step of contacting with an alkaline material is performed prior to or during the sensibly cooling step.

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14. The method of claim 3 further including the step of exposing at least a portion of the pollutant-laden liquid to an elevated temperature, thereby liberating ammonia or an ammonia derivative from the liquid.

15. The method of claim 14 wherein the ammonia derivative is urea.

16. The method of claim 14 wherein the sensibly cooling step generates heat, and at least a portion of the heat is used in the exposing step to provide at least a portion of the elevated temperature.

17. The method of claim 14 further including the step of increasing the pH of the pollutant-laden liquid.

18. The method of claim 14 wherein at least a portion of the liberated ammonia or ammonia derivative is reused by reacting the portion with additional dust-reduced flue gas, thereby forming additional reaction product.

19. The method of claim 14 wherein at least a portion of the liberated ammonia or ammonia derivative is reused by reacting the portion with additional flue gas, thereby forming additional dust-reduced flue gas.

20. The method of claim 3 further including the step of increasing the pH of the pollutant-laden liquid, thereby liberating ammonia or an ammonia derivative from the liquid.

21. The method of claim 14 further including the step of contacting at least a portion of the pollutant-laden liquid with an alkaline material, thereby forming a sulfur-containing salt.

22. The method of claim 3 further including the step of contacting at least a portion of the pollutant-laden liquid with an alkaline material, thereby forming a sulfur-containing salt.

23. The method of claim 22 wherein the alkaline material includes calcium hydroxide.

24. The method of claim 22 further including the step of separating the sulfur-containing salt from the pollution-laden liquid.

25. The method of claim 3 further including the step of heating the pollutant-laden liquid, thereby forming a sulfur-containing salt.

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26. The method of claim 3 further including the step of contacting at least a portion of the pollutant-laden liquid with the collecting liquid sufficient to saturate the pollutant-laden liquid with at least one ammonium-containing compound, thereby creating at least one insoluble sulfur-containing compound.
27. The method of claim 22 further including the step of separating a metal or metallic compound from the pollution-laden liquid.
28. The method of claim 22 further including the step of reducing the temperature of the pollutant-laden liquid, thereby forming a nitrogen-containing salt.
29. The method of claim 28 wherein the temperature-reducing step is performed subsequent to the contacting step which results in the formation of a sulfur-containing salt, thereby forming the nitrogen-containing salt subsequent to the formation of the sulfur-containing salt.
30. The method of claim 3 further including the step of reducing the temperature of the pollutant-laden liquid, thereby forming a nitrogen-containing salt.

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31. The method of claim 30 further including the step of separating the nitrogen-containing salt from the pollutant-laden liquid.

32. The method of claim 30 further including the step of increasing the pH of the pollutant-laden liquid.

33. The method of claim 3 further including the step of increasing the pH of the pollutant-laden liquid, thereby forming a nitrogen-containing salt.

34. The method of claim 3 further including the step of reducing the temperature of the liquid, thereby forming a chlorine-containing salt.

35. The method of claim 34 further including the step of separating the chlorine-containing salt from the pollutant-laden liquid.

36. The method of claim 34 further including the step of increasing the pH of the pollutant-laden liquid.

37. The method of claim 3 further including the step of increasing the pH of the pollutant-laden liquid, thereby forming a chlorine-containing salt.

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38. The method of claim 3 wherein the sensibly cooling step generates heat, and at least a portion of the heat is used to increase the temperature of the treated flue gas.

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39. A method of treating a flue gas containing a dust or a pollutant, comprising the steps of:

reacting at least a portion of the flue gas with an alkaline material, thereby forming a reaction product;

5 contacting at least a portion of the reaction product with a collecting liquid, thereby forming a pollutant-laden liquid and a treated flue gas;

10 exposing at least a portion of the pollutant-laden liquid to an elevated temperature, thereby liberating ammonia or an ammonia derivative from the liquid; and

10 reusing at least a portion of the liberated ammonia or ammonia derivative by reacting the portion with additional flue gas, thereby forming additional reaction product.

40. The method of claim 39 wherein the contacting step includes exposing the reaction product to an electrostatic precipitator.

41. The method of claim 39 further including the step of exposing the reaction product to an electrostatic precipitator.

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42. A device for treating a flue gas containing a dust or a pollutant, comprising:

a sensible-cooling heat exchanger; and
a first electrostatic precipitator.

43. The device of claim 42 wherein the sensible-cooling heat exchanger and the first electrostatic precipitator are located within a housing having a flue gas inlet and a flue gas outlet.

44. The device of claim 42 further including a collecting-liquid delivery element.

45. The device of claim 44 further including a second electrostatic precipitator.

46. The device of claim 45 wherein the second electrostatic precipitator includes a collection surface, and the collecting-liquid delivery element is capable of delivering a collecting liquid to the collection surface.

47. The device of claim 46 wherein the collecting-liquid delivery element and the second electrostatic precipitator are located within a housing having a flue gas inlet and a flue gas outlet.

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48. The device of claim 47 wherein the housing containing the collecting liquid delivery element and the second electrostatic precipitator is a second housing which is distinct from, and connected to, the housing which includes the sensible-cooling heat exchanger and the first electrostatic precipitator.

49. The device of claim 47 wherein the flue gas outlet is connected to a stack.

50. The device of claim 47 further including a pollutant-laden liquid line connected to the housing.

51. The device of claim 50 wherein the pollutant-laden liquid line includes a first chemical-separation member.

52. The device of claim 50 wherein the pollutant-laden liquid line includes a second chemical-separation member.

53. The device of claim 50 further including a spent-liquid return line connected to the pollutant-laden liquid line and to the housing.

54. The device of claim 52 wherein an ammonia/ammonia-derivative return line is connected to the pollutant-laden liquid line.

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55. The device of claim 54 wherein the ammonia/ammonia-derivative return line is connected to at least one of the first and second chemical-separation members.

56. The device of claim 50 wherein an ammonia/ammonia-derivative return line is connected to the pollutant-laden liquid line.

57. The device of claim 56 wherein the ammonia/ammonia-derivative return line is connected to the housing.

58. A device for treating a flue gas containing a dust or a pollutant, comprising:

an alkaline-material introduction element capable of introducing an alkaline material to a flue gas for reaction with at least a portion of the flue gas, thereby forming a reaction product;

5 a housing having a collecting-liquid delivery element capable of contacting a collecting liquid with at least a portion of the reaction product, thereby forming a pollutant-laden liquid and a treated flue gas, the housing further having a flue gas inlet and a flue gas outlet;

10 a temperature-elevating element capable of elevating the temperature of the pollutant-laden liquid, thereby liberating ammonia or an ammonia derivative from the pollutant-laden liquid; and

15 an ammonia/ammonia-derivative return line connected to the housing and capable of delivering liberated ammonia or an ammonia derivative to additional flue gas for the formation of additional reaction product.

59. The device of claim 58 further including an electrostatic precipitator.

60. The device of claim 59 wherein the electrostatic precipitator includes a collection surface, and the collecting-liquid delivery element is capable of delivering a collecting liquid to the collection surface.